Skin Cancer Risk Factors and Preventative Behaviors among United States Military Veterans Deployed to Iraq and Afghanistan

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TO THE EDITOR

Current military campaigns in Iraq and Afghanistan have seen the deployment of over three million soldiers to equatorial latitudes (www.va.gov/vetdata/Veteran_Population.asp and www.defense.gov/, accessed on 20 September 2014). The rate of unprotected sun exposure in these theaters is a significant concern, especially as 80% of the veterans are of Caucasian ethnicity (www.va.gov/vetdata/Veteran_Population.asp, accessed on 25 September 2011; Woolley and Hughes, 2013; Armed Forces Health Surveillance C, 2014; Lea *et al.*, 2014). Careful examination of melanoma mortality data among veterans suggests that soldiers have been exposed to high doses of intermittent UV light while deployed, which may explain frequent observations of increased risk of skin cancer in former servicemen (Brown *et al.*, 1984; Garland *et al.*, 1990; Ramani and Bennett, 1993; Page *et al.*, 2000; Yamane, 2006; Linos *et al.*, 2009; Rogers *et al.*, 2010; Strand *et al.*, 2011; Zhou *et al.*, 2011; Lea *et al.*, 2014).

We hypothesized that United States military workers had excessive exposure to UVR—during recent missions to Iraq and Afghanistan. We conducted an anonymous survey of veterans returning from Operation Enduring Freedom (OEF)/Operation Iraqi Freedom (OIF)/Operation New Dawn (OND) missions and presenting for care at the Tennessee Valley Healthcare System (TVHS) in Nashville, TN, to assess practices during deployment. Surveys ($n=212$) were analyzed from the Post-Deployment Clinic at the Nashville TVHS. Demographics (Table 1) reflected the population of the clinic with over 80% having Army branch representation, over 80% having returned more than 12 months prior, and almost 97% male. Eighty-four percent of respondents reported deployment in a desert climate, 77% spent 4 or more hours

Table 1. SPUS and sunburn by predictive factors

	No. of subjects (%)	Mean SPUS ± SD[1]	Subjects sunburned (%)	χ^2 (sunburns)[2]
Age				
18–25 (a)	27 (12.7)	**4.37 ± 1.04**[d]	18 (66.7)	
26–30 (b)	65 (30.7)	**4.58 ± 1.65**[d]	37 (56.9)	
31–35 (c)	43 (20.3)	**4.93 ± 1.62**	25 (58.1)	
>35 (d)	77 (36.3)	**5.18 ± 1.56**[a,b]	54 (70.1)	
Race				
Caucasian non-Hispanic (a)	138 (65.1)	5.00 ± 1.60	**99 (71.7)**	**c**
Caucasian Hispanic	15 (7.1)	4.60 ± 1.35	10 (66.7)	
African-American (c)	42 (19.8)	4.57 ± 1.52	**16 (38.1)**	**a**
Fitzpatrick skin type				
Types I or II (a)	38 (17.9)	5.00 ± 1.64	**31 (81.6)**	c, **d**
Type III (b)	64 (30.2)	5.09 ± 1.53	**51 (79.7)**	c, **d**
Type IV (c)	52 (24.5)	4.62 ± 1.48	**32 (61.5)**	a, b, **d**
Type V or VI (d)	54 (25.5)	4.78 ± 1.54	**19 (35.2)**	**a, b, d**
Primary duties				
Work outdoors requiring physical exertion (a)	156 (73.6)	**4.72 ± 1.61**[b]	106 (67.9)	b
All others (b)	56 (26.4)	**5.18 ± 1.40**[a]	28 (50.0)	a
Hours working in bright sun per day				
0–3 Hours (a)	48 (22.6)	**5.19 ± 1.76**[c]	**18 (37.5)**	**b, c**
4–6 Hours (b)	53 (25.0)	**5.11 ± 1.44**[c]	**34 (64.1)**	**a**
>6 Hours (c)	111 (52.4)	**4.57 ± 1.50**[a,b]	**82 (73.9)**	**a**
SPAS[3]				
0–4 Points (a)	53 (25.0)	**3.68 ± 1.31**[b]	33 (62.3)	
5–8 Points (b)	159 (75.0)	**5.23 ± 1.45**[a]	101 (63.5)	

Abbreviations: SPAS, Sun Protection Availability Score; SPUS, Sun Protection Use Score.
[1]Superscript indicates test of differences in the scores between categories of each factor in row order. Letters indicate significant differences at $P<0.05$ in comparison with other categories; boldface of the letters indicates $P<0.01$.
[2]Letters indicate significant differences at $P<0.05$ in comparison with other categories; boldface of the letters indicates $P<0.01$.

Abbreviations: OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; OND, Operation New Dawn; SPAS, Sun Protection Availability Score; SPF, sun protection factor; SPUS, Sun Protection Use Score; TVHS, Tennessee Valley Healthcare System; VA, Veterans Affair

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Table 2. Sun protection and skin cancer awareness

	Never/rarely (%)	Somewhat (%)	Always (%)
Availability of sun protection			
Sunscreen	70 (33.0)	82 (38.7)	60 (28.3)
Sunglasses	12 (5.7)	25 (11.8)	175 (82.6
Hats/headgear	17 (8.0)	14 (6.6)	181 (85.4)
Shade structures	51 (24.1)	109 (51.4)	52 (24.5
Body sites routinely unprotected			
Face	180 (84.9)		
Scalp	60 (28.3)		
Neck	159 (75.0)		
Arms/hands	150 (70.8)		
Legs	11 (5.2)		
Shoulders/back	9 (4.3)		
Stomach/chest	5 (2.4)		
Mole changes since deployment			
Subjects	61 (29)		
Made aware of risk of skin cancer by military	**Not at All**	**Somewhat**	**Very**
Subjects	88 (41.7%)	74 (35.1%)	49 (23.2%)

per day working in the bright sun, and 64% reported more than three-quarter days in bright sun.

Sunscreen use was reported as sporadic (59%), sometimes (28%), and routine (13%). Fewer than 30% reported having routine access to sunscreen while working. Most respondents reported that the face, neck, and arms/hands were unprotected 70% of the time or more. Usage of various forms of sun protection while working (sunscreen, shade structures, hat/headgear, sunglasses) was measured via a Sun Protection Use Score (SPUS) with a range of 0 to 8 (mean score, 4.84 (±1.57) and was low in all subgroups (Table 1).

A higher Sun Protection Availability Score (SPAS) measuring the availability of sunscreen, shade structures, hats, and sunglasses correlated with greater use of sun protection (r (210) = 0.59, $P < 0.0001$; Table 2). Multivariate regression revealed an association between SPUS with older age ($P = 0.03$), fewer months (<12) since return ($P = 0.04$), arid climate ($P = 0.003$), and higher SPAS ($P < 0.0001$). Those working >6 hours per day in the sun had significantly lower SPAS ($P < 0.01$).

Sixty-three percent of respondents had at least one sunburn during deployment, primarily on the face (58%), neck (59%), and arms/hands (35%). Overall, 43% had 2+ sunburns, and 20% reported blistering sunburns. Of those working >6 hours in bright sun, 74% were sunburned. Twenty-five percent of respondents working >6 hours in the sun reported blistering sunburns compared with less-exposed individuals (vs. 14%, $P = 0.047$). Multivariable regression analysis showed that Fitzpatrick skin type ($P < 0.001$), military branch ($P = 0.02$), and hours working in bright sun per day ($P < 0.001$) were associated with sunburns. SPAS and sunburns were negatively correlated, r (210) = −0.17, $P < 0.05$.

Only 23% of veterans reported that they were made very aware of the risks of skin cancer by the US military. Overall, 29% of respondents noticed a changing mole after their mission. Only 13% of veterans correctly identified the back as the most common site for melanoma in men (Table 2).

Herein, many respondents had experiences increasing their risk for skin cancer. They report significant sun exposure but only limited access to sunscreen despite their face, neck, and arms being routinely exposed to the bright sun. The combination of high intensity sun exposure, fair skin, less than optimal access, and low utilization was associated with 63% of respondents experiencing sunburn and 20% reporting a blistering sunburn.

Paradoxically, the groups with the highest occupational risk for skin cancer had the lowest utilization of sun protection. As working >6 hours in the sun was associated with lower SPAS ($P < 0.01$), access to sun protection may be an underlying issue to be improved as it has been shown in other high-exposure populations that easy access improves utilization (Dubas and Adams, 2012).

Study limitations are size of the sample, its regional nature, and its limitation to primarily one military branch. In addition, 80% of responses relied on recall of >1 year.

Future studies should expand to more national samples representing other military branches and seek greater detail on the reasons for under-utilization of sun protection and methods that are practical in the combat theater. Melanoma education and screening are important goals in this high-risk low-awareness population.

This study was conducted with the approval of the VA TVHS institutional review board and compliant with the Declaration of Helsinki Principles. Eligible research subjects included all OEF/OIF/OND veterans, 18 years and older, receiving primary care within the Nashville VA TVHS from December 2013 to May 2014. All veterans attending clinic were invited via anonymous, optional paper surveys, administered at check-in (implied consent), and deposited in a locked box.

The survey tool, developed with OEF/OIF/OND veteran input, consisted of 30 multiple choice questions addressing the latest deployment only. These included key elements of demographics, military service sun exposure, sun protection availability, sun protection utilization, and skin cancer prevention knowledge.

Study data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at Vanderbilt University (Harris *et al.*, 2009).

To analyze usage and availability of sun protection devices, sun protection scores (SPUS and SPAS) were created. Points were given for subjects' responses regarding usage of sunscreen, sunglasses, hats/headgear, or shade structures. Sporadic use received 0 points, occasional use received 1 point, and routine use received 2 points.

For statistical analysis, independent sample *t*-tests assuming unequal variance and χ^2 tests were used for group comparisons when appropriate. Pearson's correlation coefficient (*r*) was used for correlation analyses. A multivariate linear/logistic regression model was designed and performed for sun protection use and for sunburns. Two-tailed *P*-values < 0.05 were considered to be statistically significant. Statistical analyses were carried out using Stata Statistical Software, version 12 (Statacorp, College Station, TX).

CONFLICT OF INTEREST

The authors state no conflict of interest.

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Jennifer G. Powers[1,2], Neelam A. Patel[1], Edward M. Powers[1], Jonathan E. Mayer[3], George P. Stricklin[1,2] and Alan C. Geller[4]

[1]Division of Dermatology, Vanderbilt University School of Medicine, Nashville, Tennessee, USA; [2]Tennessee Valley Healthcare System, Nashville, Tennessee, USA; [3]Columbia University College of Physicians and Surgeons, New York, New York, USA and [4]Harvard School of Public Health, Boston, Massachusetts, USA
E-mail: jennifer.powers@vanderbilt.edu

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Dual mTOR Inhibition Is Required to Prevent TGF-β-Mediated Fibrosis: Implications for Scleroderma

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TO THE EDITOR

Transforming growth factor-β (TGF-β) and platelet-derived growth factor (PDGF) are central mediators of fibrosis, and their overexpression contributes to the pathophysiology of scleroderma, chiefly by inducing the overproduction of extracellular matrix proteins (ECM) by dermal fibroblasts (Gay *et al.*, 1989; Sargent *et al.*, 2010; Bhattacharyya *et al.*, 2012). TGF-β also promotes the differentiation of dermal fibroblasts into myofibroblasts, which are key mediators of scleroderma (Abraham *et al.*, 2007). Thus, targeting this pathway is a reasonable strategy to treat a variety of fibrotic diseases including scleroderma, for which current treatment options are limited. Herein we explore the potential of novel mTOR inhibition as a means to block the pro-fibrotic effects of TGF-β. Recent studies have suggested a functional role of mTOR in fibrotic diseases

Abbreviations: ECM, Extracellular matrix; MTT, (3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide); NHDF, Normal human dermal fibroblasts; PDGF, Platelet derived growth factor; TGF-β, Transforming growth factor-β

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